भारतीय मानक
Indian Standard

IS 460 (Part 3) : 2020

परीक्षण छलनी — विशिष्टि

भाग 3 परीक्षण छलनी के छिद्र को जाँचने के तरीके

(चौथा पुनरीक्षण)

Test Sieves — Specification

Part 3 Methods of Examination of Apertures of Test Sieves

(Fourth Revision)

ICS 19.120

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FOREWORD

This Indian Standard (Part 3) (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Sieves, Sieving and Other Sizing Methods Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in 1953 and subsequently revised in 1962, 1978 and 1985. The second revision of this standard was published in three parts, namely,

Part 1	Wire cloth test sieves
Part 2	Perforated plate test sieves
Part 3	Method of examination of aperture of test sieves

This Indian Standard (Part 3) deals with methods of examination of test sieves whether made from wire cloth or perforated plates for determining their compliance with Part 1 and Part 2. The fourth revision of this standard (Part 3) has been brought out in view of the experience gained during the course of implementation of this standard and also to make it technically equivalent with the following International Standards published by the International Organization for Standardization (ISO):

ISO 565-1990	Test sieves — Metal wire cloth, perforated plate and electroformed sheet — Nominal sizes of openings
ISO 3310-1 : 2016	Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth
ISO 3310-2 : 2013	Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate

The composition of the Committee responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEST SIEVES — SPECIFICATION

PART 3 METHOD OF EXAMINATION OF APERTURES OF TEST SIEVES

(Fourth Revision)

1 SCOPE

1.1 This standard (Part 3) describes the methods of examination of apertures of wire cloth test sieves [*see* IS 460 (Part 1)] and perforated plate test sieves [*see* IS 460 (Part 2)].

1.2 This standard covers acceptance test and calibration test of tests sieves. Normally the acceptance test is sufficient for determining the conformity of the apertures of the test sieve. However, when the test sieve is to be used as a master sieve and/or when more detailed information is required about it, a calibration test shall be performed.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the edition indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
460	Test sieves — Specification
(Part 1) : 2020	Wire cloth test sieves (*fourth revision*)
(Part 2) : 2020	Perforated plate test sieves (*fourth revision*)
5421 : 2013	Glossary of terms relating to test sieves and test sieving

3 GLOSSARY OF TERMS

For the purpose of this Indian Standard, the terms and definitions given in IS 5421 shall apply.

4 TEST FOR WIRE CLOTH TEST SIEVE

4.1 Every aperture in the wire cloth test sieve shall be eligible for inspection for compliance with the requirements given in IS 460 (Part 1).

4.2 The test shall proceed in various stages, starting from examination of general condition, to methodical scrutiny of individual apertures, and finally to measurement of aperture size for compliance with the applicable tolerances.

4.3 Examination of General Condition of the Wire Cloth

For this purpose the sieve cloth shall be viewed against a uniformly illuminated background. If obvious faults, for example, weaving defects, such as, loose wire, creases, wrinkles are found, the sieve is unacceptable. Part apertures are likely to be found round the periphery but blinded apertures' away from the periphery are unacceptable.

4.4 Measurement of Apertures

4.4.1 The aperture tolerances *X*, *Y* and σ_o as given in Table 1 and Table 2, of IS 460 (Part 1) shall apply to the aperture sizes as measured on the centre of the aperture, separately in warp and weft directions as per Table 1 and Fig. 1 and Fig. 2.

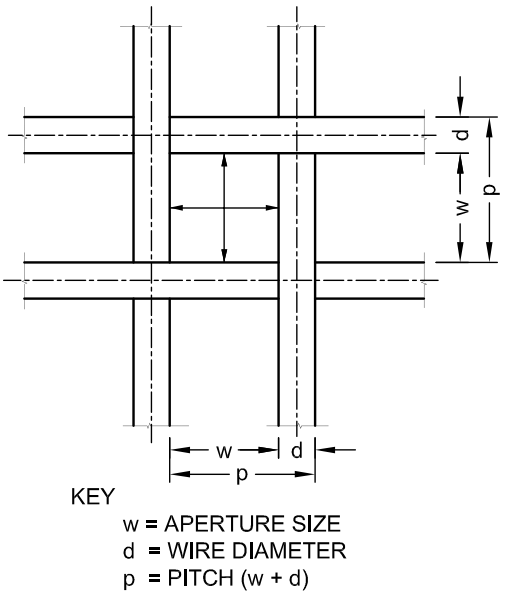
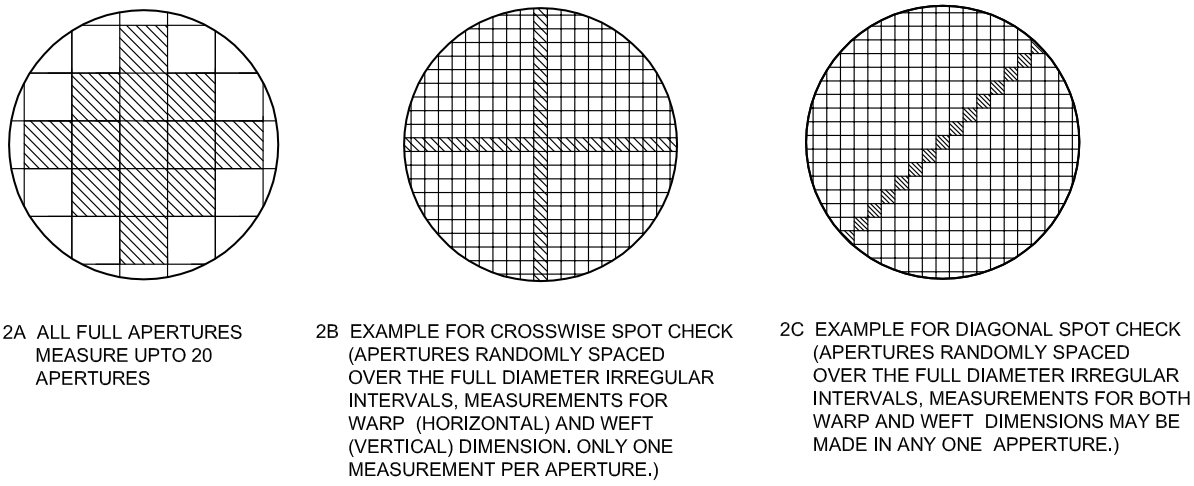


FIG. 1 POINTS OF MEASUREMENT OF APERTURE SIZE



2A ALL FULL APERTURES MEASURE UPTO 20 APERTURES

2B EXAMPLE FOR CROSSWISE SPOT CHECK (APERTURES RANDOMLY SPACED OVER THE FULL DIAMETER IRREGULAR INTERVALS, MEASUREMENTS FOR WARP (HORIZONTAL) AND WEFT (VERTICAL) DIMENSION. ONLY ONE MEASUREMENT PER APERTURE.)

2C EXAMPLE FOR DIAGONAL SPOT CHECK (APERTURES RANDOMLY SPACED OVER THE FULL DIAMETER IRREGULAR INTERVALS, MEASUREMENTS FOR BOTH WARP AND WEFT DIMENSIONS MAY BE MADE IN ANY ONE APPERTURE.)

FIG. 2 MEASUREMENT OF AVERAGE APERTURE SIZE

Table 1 Minimum Number of Apertures to be Measured Separately in Warp and Weft Directions, Randomly Spaced Over the Full Diameter

(*Clause* 4.4)

Nominal Aperture Size w	**For Acceptance**		**For Calibration**	
	Minimum Number of Apertures	*K* Factor	Minimum Number of Apertures	*K* Factor
(1)	(2)	(3)	(4)	(5)
Millimetre sizes				
125 to 25	All in both directions (*Max.* 25 in larger sieves with diameter more than 200 mm)		All in both directions (*Max*. 50 in larger sieves with diameter more than 200 mm)	
22.4 to 4	2 × 15	1.66	2 × 30	1.59
3.55 to 2.24	2 × 20	1.60	2 × 40	1.54
2 to 1.6	2 × 25	1.55	2 × 50	1.50
1.4 to 1	2 × 40	1.48	2 × 80	1.44
Micrometre sizes				
900 to 800	2 × 40	1.48	2 × 80	1.44
710 to 560	2 × 50	1.45	2 × 100	1.41
500 to 400	2 × 60	1.43	2 × 120	1.39
355 to 200	2 × 80	1.40	2 × 160	1.37
180 to 90	2 × 100	1.38	2 × 200	1.35
80 to 45	2 × 100	1.38	2 × 250	1.33
40 to 20	2 × 100	1.38	2 × 300	1.32

NOTES

1 *K* factors are used in equation given in **4.4.1.3** for the calculation of the predicted value of the standard deviation, σ_s to enhance the confidence level of the standard deviation to,

a) 99 percent for the acceptance requirement; or

b) 99.73 percent for the calibration requirement (*see* Annex A).

2 When a test sieve has 20 apertures or less, all full apertures shall be measured.

3 Explanation: 2 × 15 means 15 holes to be measured in both directions.

4.4.2 *X, Y* and σ_s may also be calculated as given in **4.4.2.1** to **4.4.2.3**.

4.4.2.1 No aperture size shall exceed the nominal size *w* by more than *X*.

$$X = \left[\frac{2w^{0.75}}{3} + 4w^{0.25}\right] \times 0.9$$

Where *X* and *w* are expressed, in micrometer (μm).

4.4.2.2 The average aperture size $\bar{w}$ shall not depart from the nominal size *w* by more than ± *Y*.

$$Y = \left[\frac{w^{0.798}}{27} + 1.6\right] \times 0.9$$

Where *Y* and *w* are expressed, in oicrometre.

4.4.2.3 The maximum standard deviation of the aperture sizes in warp and weft directions taken separately shall not exceed the values of σ_o in Tables 1 and 2, of IS 460 (Part 1). The maximum standard deviation, $\sigma_{o,}$ is calculated based on truncated normal distributions ø (*w*) where not more than 5 percent of all aperture size shall be between *w* + *Z* and *w* + *X*:

$$F(X+\bar{W}) - F(Z+\bar{W}) = \frac{\varnothing\left(\frac{X}{\sigma_0}\right) - \varnothing\left(\frac{Z}{\sigma_0}\right)}{\varnothing\left(\frac{X}{\sigma_0}\right) - \varnothing\left(\frac{\bar{Y}}{\sigma_0}\right)} = 5 \text{ percent}$$

$$Z = \frac{+X + |+Y|}{2}$$

Where $\varnothing\left(\frac{w-\bar{w}}{\sigma_0}\right)$ represents the normal distribution, in cumulative form.

The standard deviation *s* is calculated from the measurement of the number of apertures, *n*, listed in Table 1, using equation:

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(w_i - w)^2}$$

The predicted value, σ_s, of the standard deviation may be calculated from equation:

$$\sigma_s = K.s$$

Where values of *K* are obtained from Table 1.

Values of *K* may also be calculated as per the equations given below, a typical example for the evaluation of the standard deviation is given in Annex A.

K for acceptance test:

$$K = 1.2 + \frac{2.5}{\sqrt{2n}}$$

K for calibration test:

$$K = 1.2 + \frac{3.0}{\sqrt{2n}}$$

4.5 Wire Diameter

4.5.1 The wire diameter of wire cloth shall conform to requirement specified in Table 1 and Table 2 of IS 460 (Part 1) with applicable tolerances.

4.5.2 The wires in a test sieve shall have a same diameter and material in the warp and weft directions.

Table 2 Minimum Number of Holes to be Measured in Test Sieve

(*Clauses* 4.4.1 *and* 5.5.1)

Nominal Sizes of Holes, *w* mm	Process for Compliance and Inspection	Process for Calibration
(1)	(2)	(3)
125 to 22, 4	All (maximum 25 in larger sieves with diameter more than 200 mm)	All (maximum 50 in larger sieves with diameter more than 200 mm)
20 to 4	2 × 15	2 × 30
3.55 to 2.24	2 × 20	2 × 40
2 to 1.6	2 × 25	2 × 50
1.4 to 1	2 × 40	2 × 80

NOTE — Where the minimum number of holes prescribed for examination in one or two directions are not available in the plate, all the holes in the sieve shall be checked.

5 TEST FOR PERFORATED PLATE TEST SIEVE

5.1 Every aperture in the perforated plate test sieve shall be eligible for inspection for compliance with the requirements given in IS 460 (Part 2).

5.2 The test shall proceed in various testing stages, starting from examination of general condition, to methodical scrutiny of individual apertures, and finally to measurement of aperture size for compliance with the applicable tolerances.

5.3 Measuring of the dimensions of holes and the pitches, *p*, over any selected area of the plate. If the dimension of any hole exceeds the tolerance, the sieve is unacceptable.

5.4 Examination of General Condition of the Perforated Plate

The perforated plate in the sieve shall be examined for general condition against a uniformly illuminated background and if obvious faults, such as irregularly formed holes, ragged edges, and burrs upward are found, the sieve is unacceptable.

5.5 Measurement of Apertures

5.5.1 *Measurement of Individual Holes*

Individual holes shall be checked for compliance with the prescribed tolerances. Square holes shall be checked at the mid-section in both directions across round holes across various diameters as per the Table 2. Callipers, tapered plate gauges, segmental plain limit plug gauges, or optical projection may be used. The following procedures shall be adopted for measurement of holes:

a) In any selected area check the holes along each of two straight lines of at least 150 mm length and including at least 10 holes, 5 along each direction. The lines should be at 90° or 60° for round holes and at 90° for square holes.

b) Alternatively for square holes, check holes along a line parallel to a diagonal of the holes for at least 150 mm and at least 8 holes.

5.5.2 *Measurement of Pitch of the Apertures*

The pitch of the apertures shall be checked. This can be done at the same time as the test under **5.5.1**.

ANNEX A

(*Table* 1 *and Clause* 4.4.2.3)

DETERMINATION OF THE STANDARD DEVIATION ON AVERAGE APERTURE SIZE

A-1 The standard deviation is calculated as per **4.4** are illustrated by the following two examples:

Example 1 : With n = 25 (nominal aperture w = 2.0 mm), for Acceptance Requirement

w_i	n_i	$n_i \times w_i$	$(w_i - \bar{w})$	$(w_i - \bar{w})^2$	$n_i(w_i - \bar{w})^2$
1.812	0	0.000	-0.132	0.017	0.000
1.859	3	5.577	-0.085	0.007	0.021
1.906	5	9.530	-0.038	0.001	0.007
1.953	11	21.483	0.009	0.000	0.001
2.000	6	12.000	0.056	0.003	0.019
2.047	0	0.000	0.103	0.011	0.000
2.094	0	0.000	0.150	0.023	0.000
2.141	0	0.000	0.197	0.039	0.000
2.188	0	0.000	0.244	0.060	0.000
n =	25	48.590			0.049

Calculation

$$\bar{w} = \frac{1}{n}\sum_{i=1}^{n} w_1$$

$$\bar{w} = \frac{48.59}{25} = 1.944\ mm$$

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(w_i - \bar{w})^2}$$

$$s = \sqrt{\frac{1}{25-1} \times 0.049} = 0.045 \text{ mm}$$

For the acceptance requirement, this value of s shall be multiplied by the factor K to enhance the confidence level of the standard deviation to 99 percent.

$$\sigma_s = K \,.\, s$$

$$\sigma_s = 1.55 \times 0.045 = 0.070 \text{ mm}$$

Standard deviation σ_s = 0.070 shall be compared with the value of σ_0 = 0.083 given in Table 1 and Table 2, col 6 of IS 460 (Part 1).

Example 2 : With n = 50 (nominal aperture size w = 2.0 mm), for Calibration Requirement

w_i	n_i	$n_i \times w_i$	$(w_i - \bar{w})$	$(w_i - \bar{w})^2$	$n_i(w_i - \bar{w})^2$
1.812	0	0.000	-0.187	-1.187	0.000
1.859	1	1.859	-0.140	-0.140	0.020
1.906	3	5.718	-0.093	-0.093	0.026
1.953	10	19.530	-0.046	-0.046	0.021
2.000	22	44.000	0.001	0.001	0.000
2.047	11	22.517	0.048	0.048	0.025
2.094	2	4.188	0.095	0.095	0.018
2.141	1	2.141	0.142	0.142	0.020
2,188	0	0.000	0.189	0.189	0.000
n =	50	99.953			0.130

Calculation

$$\bar{w} = \sum_{i=1}^{n} n_i . w_i$$

$$\bar{w} = \frac{99.953}{50} = 1.999 \text{ mm}$$

$$x = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(w_i - \bar{w})^2}$$

$$x = \sqrt{\frac{1}{50-1} \times 0.130} = 0.052 \text{ mm}$$

For the calibration requirement, this value of s shall be multiplied by the K factor to enhance the confidence level of the standard deviation to 99.73 percent.

$$\sigma_s = K \,.\, s$$

$$\sigma_s = 1.50 \times 0{,}052 = 0.077 \text{ mm}$$

The standard deviation σ_s = 0.077 shall be compared with the value of σ_0 = 0.083 given in Table 1 and Table 2, col 6 of IS 460 (Part 1).

ANNEX B

(*Foreword*)

COMMITTEE COMPOSTION

Sieves, Sieving and Other Sizing Methods Sectional Committee, CED 55

Organization	*Representative(s)*
In Personal Capacity (*90, Savita Vihar, Vikas Marg, Delhi 110092*)	Dr R. P. Singhal (***Chairman***)
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